

The documentation and process conversion measures necessary to comply with this revision shall be completed by 12 November 1997

INCH-POUND

MIL-PRF-19500/394C
12 August 1997
SUPERSEDING
MIL-S-19500/394B
24 March 1993

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, POWER SWITCHING
TYPES 2N4150, 2N5237, 2N5238, 2N4150S, 2N5237S, AND 2N5238S
JAN, JANTX, JANTXV, AND JANS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for NPN, silicon, power switching transistors for use in high-speed power switching applications. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (TO-5).

1.3 Maximum ratings.

Types	P_T		V_{CBO}	V_{CEO}	V_{EBO}	I_C	T_{STG} and T_{OP}	$R_{\theta JC}$ (max)	$R_{\theta JA}$ (max)
	$T_A = +25^\circ\text{C}$ 1/	$T_C = +100^\circ\text{C}$ 2/							
	<u>W</u>	<u>W</u>	<u>V dc</u>	<u>V dc</u>	<u>A dc</u>	<u>A dc</u>	<u>°C</u>	<u>°C/mW</u>	<u>°C/mW</u>
2N4150, S	1.0	5.0	100	70	10	10	-65 to +200	.020	.175
2N5237, S	1.0	5.0	150	120	10	10	-65 to +200	.020	.175
2N5238, S	1.0	5.0	200	170	10	10	-65 to +200	.020	.175

1/ Derate linearly 5.7 mW/°C for $T_A > +25^\circ\text{C}$.

2/ Derate linearly 50 mW/°C for $T_C > +25^\circ\text{C}$.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A
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FSC 5961

1.4 Primary electrical characteristics.

Limits	h_{FE2} 1/ $I_C = 5$ A dc $V_{CE} = 5$ V dc	h_{FE3} 1/ $I_C = 10$ A dc $V_{CE} = 5$ V dc	C_{obo} $I_E = 0$ $V_{CB} = 10$ V dc 100 kHz \leq $f \leq 1$ MHz	h_{fe} $I_C = 0.2$ A dc $V_{CE} = 10$ V dc $f = 10$ MHz	$V_{BE(SAT)}$ 1/ $I_C = 5$ A dc $I_B = 0.5$ A dc 1/	$V_{BE(SAT)}$ 1/ $I_C = 5$ A dc $I_B = 0.5$ A dc 1/
Min	40	10	pF	1.5	V dc	V dc
Max	120		350	7.5	1.5	0.6

1/ Pulsed (see 4.5.1).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

STANDARD

MILITARY

MIL-STD-750 - Test Methods for Semiconductor Devices.

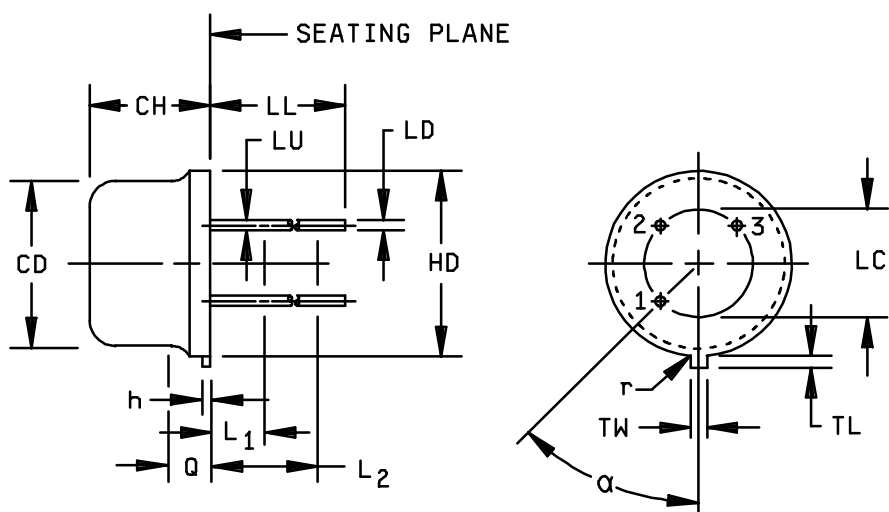
(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

3.2 Associated specification. The individual item performance requirements shall be in accordance with MIL-PRF-19500, and as specified herein.



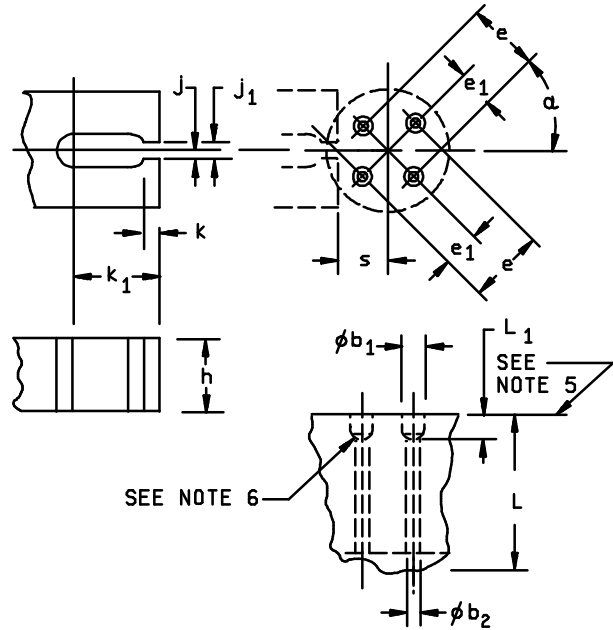
Symbol	Dimensions				Notes	Symbol	Dimensions				Notes
	Inches		Millimeters				Inches		Millimeters		
	Min	Max	Min	Max			Min	Max	Min	Max	
CD	.305	.335	7.75	8.51		L ₁	---	.050	---	1.27	7
CH	.240	.260	6.10	6.60		L ₂	.250	---	6.35	---	7
h	.009	.041	0.23	1.04		Q	---	.050	---	1.27	4, 13
HD	.335	.370	8.51	9.40		r	---	.010	---	0.25	11, 12
LC	.200 TP		5.08 TP		6	TL	.029	.045	0.74	1.14	3
LD	.016	.021	0.41	0.53	7	TW	.028	.034	0.71	0.86	10
LL	See notes 14 and 15					α	45° TP		45° TP		6
LU	.016	.019	0.41	0.48	7						

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Symbol TL is measured from HD maximum.
4. Lead number 4 omitted on this variation.
5. CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
6. Leads at gauge plane .054 inch (1.37 mm) + .001 inch (0.03 mm) -.000 inch (0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) relative to the tab. The device may be measured by direct methods or by the gauge and gauging procedure described on gauge drawing on figure 2.
7. LD applies between L₁ and L₂. Dimension LD applies between L₂ and LL minimum. Lead diameter shall not exceed .042 inch (1.07 mm) within L₁ and beyond LL minimum.
8. Lead designation is as follows: 1 - emitter; 2 - base; 3 - collector.
9. Lead number three is electrically connected to case.
10. Beyond r maximum, TW shall be held for a minimum length of .011 inch (0.28 mm).
11. r (radius) applies to both inside corners of tab.
12. Tab shown omitted.
13. Details of outline in this zone optional.
14. For transistor types 2N4150S, 2N5237S and 2N5238S, dimension LL = .500 inch (12.70 mm) minimum, and .750 inch (19.05 mm) maximum.
15. For transistor types 2N4150, 2N5237 and 2N5238, dimension LL = 1.500 inches (38.10 mm) minimum, and 1.750 inches (44.45 mm) maximum.

FIGURE 1. Physical dimensions.

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
e	.1995	.2005	5.07	5.09
e ₁	.0995	.1005	2.53	2.55
fb ₁	.0595	.0605	1.511	1.537
fb ₂	.0325	.0335	0.824	0.851
h	.150 Nom		3.81 Nom	
j	.0175	.0180	0.44	0.46
j ₁	.0350	.0355	0.89	0.90
k	.009	.011	0.23	0.28
k ₁	.125 Nom		3.18 Nom	
L	.372	.378	9.45	9.60
L ₁	.054	.055	1.37	1.40
S	.182	.199	4.62	5.05
μ	44.90°	45.10°	44.90°	45.10°



NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The location of the tab locator, within the limits indicated, will be determined by the tab and flange dimension of the device being checked.
4. The following gauging procedure shall be used: The use of a pin straightener prior to insertion in the gauge is permissible. The device being measured shall be inserted until its seating plane is .125 ±.010 inch (3.18 ±.025 mm) from the seating surface of the gauge. A spacer may be used to obtain the .125 inch (3.18 mm) distance from the gauge seat prior to force application. A force of 8 inch-ounce ±.50 inch-ounce shall then be applied parallel and symmetrical to the device's cylindrical axis. When examined visually after the force application (the force need not be removed), the seating plane of the device shall be seated against the gauge.
5. Gauging plane.
6. Drill angle.

FIGURE 2. Gauge for lead and tab location.

3.3 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500.

3.3 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL-PRF-19500 and on figure 1 herein.

3.3.1 Lead material and finish. Unless otherwise specified, lead material shall be Kovar, Alloy 52 or approved equivalent. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein.

3.3.2 Diode construction. These devices shall be constructed in a manner and using materials which enable the diodes to meet the applicable requirements of MIL-PRF-19500 and this document.

3.4 Marking. Devices shall be marked as specified in MIL-PRF-19500.

3.5 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I.

3.6 Electrical test requirements. The electrical test requirements shall be the subgroups specified in 4.4.2 and 4.4.3.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2).
- b. Screening (see 4.3)
- c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500.

4.3 Screening (JANTX JANTXV and JANS levels only). Screening shall be in accordance with MIL-PRF-19500 (Appendix E, table IV), and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see appendix E, (see table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
9	I_{CBO} and h_{FE1}	Not applicable
11	I_{CBO} and h_{FE1} ; $\Delta I_{CBO} = 50$ nA dc or ± 100 percent from the initial value, whichever is greater; $\Delta h_{FE1} = +20$ percent and -10 percent	I_{CBO} and h_{FE2}
12	See 4.3.1	See 4.3.1
13	Subgroups 2 and 3 of table I herein; $\Delta I_{CBO} = 50$ nA dc or ± 100 percent from the initial value, whichever is greater.	Subgroup 2 of table I herein; $\Delta I_{CBO} = 50$ nA dc or ± 100 percent from the initial value, whichever is greater. $\Delta h_{FE2} = +20$ percent and -10 percent.

4.3.1 Power burn-in test conditions. Power burn-in conditions are as follows:

T_A = room ambient as defined in the general requirements of 4.5 of MIL-STD-750.

V_{CB} = 10 V dc; P_T = 1.0 W.

NOTE: No heat sink or forced air cooling on the devices shall be permitted.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with appendix E, table V of MIL-PRF-19500, and table I herein. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table II herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, tables VIa (JANS) and table VIb (JAN, JANTX and JANTXV) of MIL-PRF-19500. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table II herein.

4.4.2.1 Group B inspection, appendix E, table VIa of MIL-PRF-19500.

Subgroup	Method	Conditions
B4	1037	$T_A = +25^\circ\text{C} \pm 3^\circ\text{C}$; $V_{CB} = 10$ V dc; $P_T = 1.0$ W, $t_{on} = t_{off} = 3$ minutes minimum for 2,000 cycles. No heat sink nor forced air cooling on the device shall be permitted.
B5	1027	$V_{CB} = 10$ V dc; $P_T = 1.0$ W at $T_A = +100^\circ\text{C}$ (or $P_T = 1.43$ W at $T_A = +25^\circ\text{C}$) for 96 hours.
B5	3131	See 4.5.2.

4.4.2.2 Group B inspection, appendix E, table VIb of MIL-PRF-19500.

Subgroup	Method	Conditions
B3	1027	$V_{CB} = 10$ V dc; $P_T = 1.0$ W at T_A = room ambient as defined in the general requirements of 4.5 of MIL-STD-750. No heat sink nor forced air cooling on the device shall be permitted.
B3	2037	Test condition A; all internal leads for each device shall be pulled separately.
B5	3131	See 4.5.2

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table VII of MIL-PRF-19500. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table II herein.

4.4.3.1 Group C inspection, appendix E, table VII of MIL-PRF-19500.

Subgroup	Method	Conditions
C2	2036	Test condition E.
C6	1026	$V_{CB} = 10$ V dc; $P_T = 1.0$ W at $T_A = +25^\circ\text{C} \pm 3^\circ\text{C}$. No heat sink nor forced air cooling on the device shall be permitted.

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table IX of MIL-PRF-19500, and as follows. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table II herein.

4.4.4.1 Group E inspection appendix E, table IX of MIL-PRF-19500.

Subgroup	Method	Conditions
E1	1051	Condition G, 500 cycles; 45 devices, c = 0.
E1	1071	
E2	1039 or 1048	Test condition A, 340 hours; 45 devices, c = 0.
E3		Not applicable
E4	3131	See 4.5.2, 22 devices, c = 0.
E5		Not applicable

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

4.5.2 Thermal resistance. Thermal resistance measurements shall be performed in accordance with method 3131 of MIL-STD-750. The maximum limit of $R_{\theta JC(max)}$ shall be 20°C/W. The following test conditions shall apply:

- a. I_M : Collector current.....10 mA.
- b. V_{CE} : Measurement current (same as V_H).....10 V dc.
- c. I_H : Collector heating current.....0.375 A.
- d. V_H : Collector-emitter heating voltage10 V dc.
- e. t_H : Heating time 1.0 s.
- f. t_{MD} : Measurement delay time..... 30 to 60 μ s.
- g. t_{SW} : Sampling window time10 μ s maximum.

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical evaluation	2071					
<u>Subgroup 2</u>						
Breakdown voltage, collector to base	3001	Bias condition D, $I_C = 10 \mu A$ dc	$V_{(BR)CBO}$			
2N4150, 2N4150S				100		V dc
2N5237, 2N5237S				150		V dc
2N5238, 2N5238S				200		V dc
Breakdown voltage, collector to emitter	3011	Bias condition D, $I_C = 0.1$ A dc, pulsed (see 4.5.1)	$V_{(BR)CEO}$			
2N4150, 2N4150S				70		V dc
2N5237, 2N5237S				120		V dc
2N5238, 2N5238S				170		V dc
Breakdown voltage, emitter to base	3026	Bias condition D, $I_E = 10 \mu A$ dc	$V_{(BR)EBO}$	7		V dc
Collector to emitter cutoff current	3041	Bias condition D	I_{CEO1}			
2N4150, 2N4150S		$V_{CE} = 60$ V dc			10	μA dc
2N5237, 2N5237S		$V_{CE} = 110$ V dc			10	μA dc
2N5238, 2N5238S		$V_{CE} = 160$ V dc			10	μA dc
Collector to emitter cutoff current	3041	Bias condition A, $V_{BE} = 0.5$ V dc	I_{CEX}			
2N4150, 2N4150S		$V_{CE} = 100$ V dc			10	μA dc
2N5237, 2N5237S		$V_{CE} = 150$ V dc			10	μA dc
2N5238, 2N5238S		$V_{CE} = 200$ V dc			10	μA dc
Emitter to base cutoff current	3061	Bias condition D, $V_{EB} = 5$ V dc	I_{EBO}		0.1	μA dc
Collector to base cutoff current	3036	Bias condition D, $V_{CB} = 80$ V dc	I_{CBO}		0.1	μA dc
Forward-current transfer ratio	3076	$V_{CE} = 5$ V dc, $I_C = 1$ A dc, pulsed (see 4.5.1)	h_{FE1}			
2N4150, 2N4150S				50	200	
2N5237, 2N5237S				50	225	
2N5238, 2N5238S				50	225	

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> - Continued						
Forward-current transfer ratio	3076	V _{CE} = 5 V dc, I _C = 5 A dc, pulsed (see 4.5.1)	h _{FE2}	40	120	
Collector to emitter voltage (saturated)	3071	I _C = 5 A dc, I _B = 0.5 A dc, pulsed (see 4.5.1)	V _{CE(sat)1}		0.6	V dc
Collector to emitter voltage (saturated)	3071	I _C = 10 A dc, I _B = 1 A dc, pulsed (see 4.5.1)	V _{CE(sat)2}		2.5	V dc
Base emitter voltage saturation	3066	Test condition A, I _B = 0.5 A dc, I _C = 5 A dc, pulsed (see 4.5.1)	V _{BE(sat)1}		1.5	V dc
Base emitter voltage saturation	3066	Test condition A, I _B = 1 A dc, I _C = 10 A dc, pulsed (see 4.5.1)	V _{BE(sat)2}		25	V dc
Forward-current transfer ratio	3076	V _{CE} = 5 V dc, I _C = 10 A dc, pulsed (see 4.5.1)	h _{FE3}	10		
<u>Subgroup 3</u>						
High-temperature operation:		T _C = +150°C				
Collector to emitter cutoff current	3041	Bias condition A, V _{BE} = -0.5 V dc	I _{CEX2}			
2N4150, 2N4150S		V _{CE} = 80 V dc			100	μA dc
2N5237, 2N5237S		V _{CE} = 150 V dc			100	μA dc
2N5238, 2N5238S		V _{CE} = 200 V dc			100	μA dc
Low temperature operation:	3076	T _A = -55°C				
Forward current transfer ratio		V _{CE} = 5 V dc. I _C = 5 A dc, pulsed (see 4.5.1)	h _{FE4}	20		

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/ 	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 4</u>						
Magnitude of common emitter small-signal short-circuit forward-current transfer ratio	3306	$V_{CE} = 10 \text{ V dc}$, $I_C = 0.2 \text{ A dc}$, $f = 10 \text{ MHz}$	$ h_{fe} $	1.5	7.5	
Small-signal short-circuit forward-current transfer ratio						
2N4150, 2N4150S				40	160	
2N5237, 2N5237S				40	160	
2N5238, 2N5238S				40	250	
Open circuit output capacitance	3236	$V_{CB} = 10 \text{ V dc}$, $I_E = 0$, $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	C_{obo}		350	pF
Pulse response	3251	Test condition A				
Delay time		See figure 4	t_d		50	ns
Rise time		See figure 4	t_r		500	ns
Storage time		See figure 4	t_s		1.5	ns
Fall time		See figure 4	t_f		500	ns
<u>Subgroup 5</u>						
Safe operating area (continuous dc)	3051	$T_C = +25^\circ\text{C}$, $t = 1.0 \text{ s}$				
Test 1		$V_{CE} = 40 \text{ V dc}$ $I_C = 0.22 \text{ A}$				
Test 2		$V_{CE} = 70 \text{ V dc}$, $I_C = 90 \text{ mA}$				
Test 3						
2N5237, 2N5237S only		$V_{CE} = 120 \text{ V dc}$, $I_C = 15 \text{ mA}$				
2N5238, 2N5238S only		$V_{CE} = 170 \text{ V dc}$, $I_C = 3.5 \text{ mA}$				
Clamped inductive sweep	3053	$T_C = +100^\circ\text{C}$ minimum $I_B = 0.5 \text{ A dc}$, $I_C = 5 \text{ A dc}$, (see figure 5)				
Electrical measurements		See table II, steps 1 and 4				

1/ For sampling plan, see MIL-PRF-19500.

TABLE II. Groups A, B, C, and E electrical measurements. 1/ 2/ 3/ 4/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Collector to base cutoff current	3036	Bias condition D, $V_{CB} = 80 \text{ V dc}$	I_{CBO}		0.1	$\mu\text{A dc}$
2.	Emitter to base cutoff current	3061	Bias condition D, $V_{EB} = 5 \text{ V dc}$	I_{EBO}		0.1	$\mu\text{A dc}$
3.	Forward-current transfer ratio	3076	$V_{CE} = 5 \text{ V dc}$, $I_C = 1 \text{ A dc}$, pulsed (see 4.5.1)	h_{FE1}			
	2N4150, 2N4150S 2N5237, 2N5237S 2N5238, 2N5238S				50 50 50	200 225 225	
4.	Forward-current transfer ratio	3076	$V_{CE} = 5 \text{ V dc}$ $I_C = 5 \text{ A dc}$, pulsed (see 4.5.1)	h_{FE2}	40	120	
5.	Collector to emitter voltage (saturated)	3071	$I_C = 5 \text{ A dc}$, $I_B = 0.5 \text{ A dc}$, pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.6	V dc
6.	Base emitter voltage saturation	3066	Test condition A, $I_C = 5 \text{ A dc}$, pulsed (see 4.5.1)	$V_{BE(sat)1}$		1.5	V dc
7.	Forward current transfer ratio	3076	$V_{CE} = 5 \text{ V dc}$, $I_C = 1 \text{ A dc}$, pulsed (see 4.5.1)	Δh_{FE1}		+ 20 percent and -10 percent from previously measured value	
8.	Forward current transfer ratio	3076	$V_{CE} = 5 \text{ V dc}$, $I_C = 5 \text{ A dc}$, pulsed (see 4.5.1)	Δh_{FE2}		20 percent and -10 percent from previously measured value	
9.	Collector to base cutoff current	3036	Bias condition D, $V_{CB} = 80 \text{ V dc}$	ΔI_{CBO}		± 100 percent or 50 nA, whichever is greater.	
10.	Collector to emitter voltage (saturated)	3071	$I_C = 5 \text{ A dc}$, $I_B = 0.5 \text{ A dc}$, pulsed (see 4.5.1)	$\Delta V_{CE(sat)1}$		$\pm 50 \text{ mV dc}$ change from previously measured value.	

TABLE II. Groups A, B, C, and E electrical measurements - Continued. 1/ 2/ 3/ 4/

- 1/ The electrical measurements for appendix E, table VIa (JANS) of MIL-PRF-19500 are as follows:
- a. Subgroup 3, see table II herein, steps 1, 4, 5, 6, and 10.
 - b. Subgroup 4, see table II herein, steps 1, 4, 5, 6, and 10.
 - c. Subgroup 5, see table II herein, steps 1, 2, 4, 5, 6, 8, 9, and 10.
- 2/ The electrical measurements for appendix E, table VIb (JANTX and JANTXV) of MIL-PRF-19500 are as follows:
- a. Subgroup 2, see table II herein, steps 1, 2, and 4.
 - b. Subgroup 3, see table II herein, steps 1, 2, and 8.
 - c. Subgroup 6, see table II herein, steps 1, 2, and 8.
- 3/ The electrical measurements for appendix E, table VII of MIL-PRF-19500 are as follows:
- a. Subgroup 2, see table II herein, steps 1, 2, and 4.
 - b. Subgroup 3, see table II herein, steps 1, 2, and 4.
 - c. Subgroup 6, see table II herein, steps 1, 2, and 8.
- 4/ The electrical measurements for appendix E, table IX of MIL-PRF-19500 are as follows:
- a. Subgroup 1, see table II herein, steps 1, 2, 3, 4, 5, 6, 7, and 8.
 - b. Subgroup 2, see table II herein, steps 1, 2, 3, 4, 5, 6, and 7.

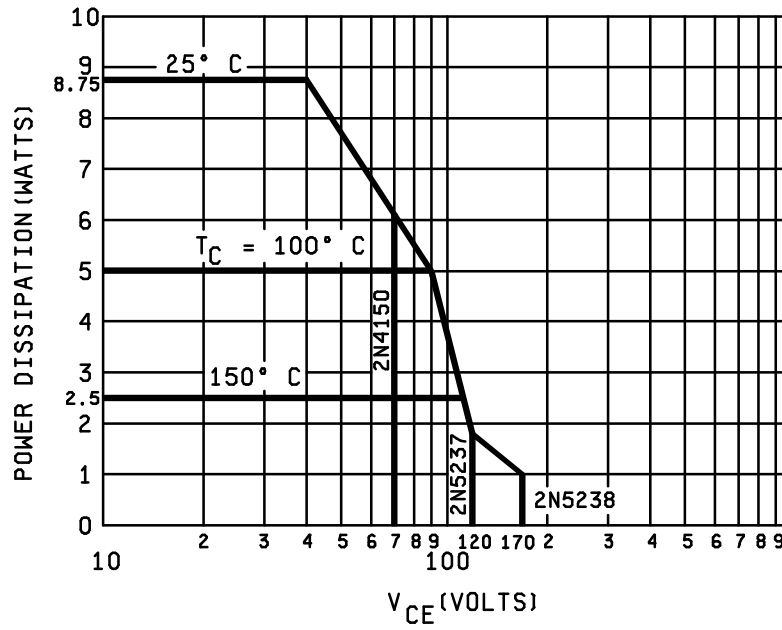


FIGURE 3. Maximum operating conditions - dc forward biased mode.

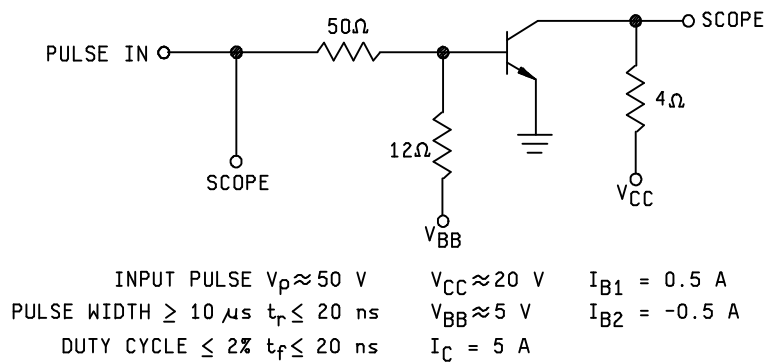
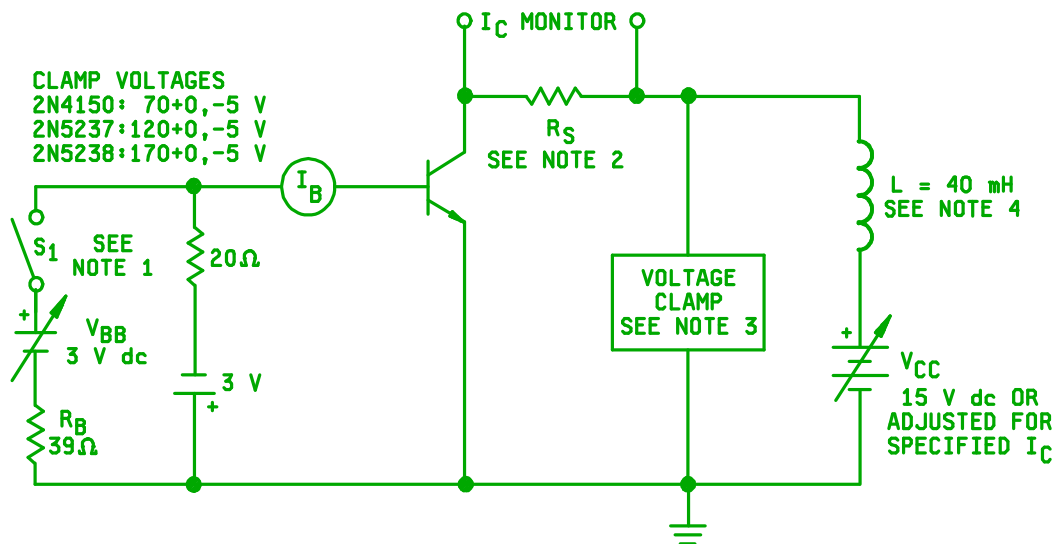


FIGURE 4. Speed of response test circuit.



NOTES:

1. An appropriate pulse generator may be substituted.
2. $R_S \leq 1.0 \Omega$ noninductive.
3. Clamp voltage: 2N4150: 70 V dc +0 V dc, -5 V dc; 2N5237: 120 V dc +0 V dc, -5 V dc; 2N5238: 170 V dc +0 V dc, -5 V dc.
4. STANCOR C-2691 or equivalent; 2 in series.

FIGURE 5. Clamped inductive sweep test circuit.

5. PACKAGING

5.1 Packaging. Packaging shall prevent mechanical damage of the devices during shipping and handling and shall not be detrimental to the device. When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

5.2 Marking. Unless otherwise specified (see 6.2), marking shall be in accordance with MI:-STD-129.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Notes. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. See MIL-PRF-19500.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No.19500 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from, Defense Supply Center Columbus, ATTN: DSCC-VQE, 3990 East Broad Street, Columbus, OH 43216-5000.

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:
Army - CR
Navy - EC
Air Force - 17

Preparing activity:
DLA - CC
(Project 5961-1776)

Review activities:
Army - MI
Air Force - 13, 19, 85, 99

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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-S-16500/364C

2. DOCUMENT DATE (YYMMDD)
970812

3. DOCUMENT TITLE SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, POWER SWITCHING; TYPES 2N4150, 2N5237, 2N5238, 2N4150S, 2N5237S, AND 2N5238S; JAN, JANTX, JANTXV, AND JANS

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION**6. SUBMITTER**

a. NAME (Last, First, Middle initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

(1) Commercial

(2) AUTOVON
(If applicable)

7. DATE SUBMITTED
(YYMMDD)

8. PREPARING ACTIVITY

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c. ADDRESS (Include Zip Code) , Defense Supply Center Columbus, ATTN: DSCC-VAT, 3660 East Broad Street, Columbus, OH 43216-5000

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